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Chapter 4. Conveyance — Delta

The Delta — A Brief Overview

The Delta is the confluence point of the Sacramento and San Joaquin rivers as water is naturally conveyed westward from upstream water basins to the bays connected to the Pacific Ocean (Figure 4-1). In its natural state, the Delta was a vast marsh and floodplain dissected by meandering channels and sloughs. Even in today's highly altered environment (see below), the Delta remains a critical ecosystem and dynamic habitat that is home to hundreds of aquatic and terrestrial species, including many species endemic to the area and a number that are designated as threatened or endangered by the federal Endangered Species Act (ESA) and California Endangered Species Act (CESA).

PLACEHOLDER Figure 4-1 Sacramento-San Joaquin River Delta

[Any draft tables, figures, and boxes that accompany this text for the advisory committee draft are included at the end of this chapter.]

The Delta is also a centerpiece of California's water system. The conveyance of water through the Delta supplies water for over 25 million Californians. The water conveyed through the Delta also supports farms and ranches stretching from the north Delta to California-Mexico border, which collectively produce nearly half of the nation's domestically grown fresh produce and supports a $27 billion agricultural industry. In addition to being a key recreational destination, the Delta supports extensive infrastructure of statewide importance, such as aqueducts, natural gas pipelines, electricity transmission lines, railroads, shipping channels and highways.

Infrastructure Changes to Delta Conveyance — A Brief History

Concerted efforts to control and redirect the flow of water through the Delta began as early as the 1850s. Early water supply diversion projects included the construction of network of levees that facilitated the conveyance of water for agriculture and human consumption uses. The straightening, widening and dredging of channels similarly increased shipping access to the Central Valley and improved downstream water conveyance for flood control.

California's post-World War II growth resulted in the planning and construction of two large scale water projects with an emphasis on conveying water to develop and sustain California's agricultural economy and urban growth. The Central Valley Project (CVP), which was initiated in 1933 and is operated and maintained by the U.S. Bureau of Reclamation (Reclamation), is comprised of twenty (20) dams and reservoirs with a combined storage capacity of more than 11 million acre-feet, eleven (11) power plants, and more than 500 miles of major canals and aqueducts. The CVP provides sufficient water to irrigate one-third of California's agricultural land and to meet the municipal and industrial needs of close to 1 million households annually.

The State Water Project (SWP), which was initially authorized by voters in 1960 and is operated and maintained by the California Department of Water Resources (DWR), is a complex system now comprised of twenty (20) pumping plants, five (5) hydroelectric power plants, thirty-four (34) storage reservoirs and lakes with combined storage capacity of approximately 5.8 million acre-feet, and

approximately 700 miles of pipelines and canals. The SWP provides water for over 20 million Californians, about 660,000 acres of irrigated farmland, and distributes water under contract to twenty-nine (29) urban and agricultural water suppliers (SWP contractors).

The Delta is a critical component of both water projects, which rely on the Delta conveyance system to provide water at their diversion facilities in the south Delta for use in the San Francisco Bay Area, the Central Valley and southern California. Other agencies and facilities, such as the Contra Costa Water District, the East Bay Municipal Utility District, the City of Stockton, and the Folsom South Canal also rely on the Delta as a source of supply or as a transportation corridor for their water supply facilities.

Current Diversion and Future Impacts on the Delta Ecosystem — A Brief Overview

Once a vast marsh and floodplain dissected by meandering channels and sloughs, the Delta provided a dynamic habitat for a rich diversity of fish, wildlife, and plants. The Delta of today has been altered by a system of man-made levees, reservoirs, and dredged waterways constructed to support farming and urban development, as well as to provide flood protection on lands that historically supported marshes and floodplains. The water flow in the Delta is also affected by the movement of water for operations of the SWP and CVP. Many other factors have compounded the alteration of the Delta and include the introduction of invasive non-native fish; wildlife and plant species; barriers to fish migration; changes in Delta water quality constituents; turbidity and toxicity from both natural and human sources; unscreened power plan and agricultural diversion; changed water salinity due primarily to reduced Delta outflow and increased agricultural runoff; illegal fish harvesting; and improper hatchery management practices.

The Delta future will be affected by worsening land subsidence, heightened seismic risk and possible effects of climate change which include sea level rise and changes in storm timing, intensity and frequency.

In this highly altered environment, several fish species have declined to the lowest population numbers in their recorded histories. In response, federal regulatory actions to protect threatened and endangered fish species have limited through-Delta conveyance and have made water supplies increasingly variable.

The Bay Delta Conservation Plan (BDCP) — Achieving the Co-Equal Goals Ecosystem Restoration and Water Supply Reliability

Brief History and Purpose of the BDCP

Over the past several decades, increasing demand for the Delta's resources have increased the conflict between the needs of water users and efforts to sustain the estuary's aquatic ecosystem and support recovery of State and federally listed fish. These conflicts have led to a crisis regarding the ability to protect Delta fisheries, maintain water quality, and meet the needs of both in-Delta and export area agricultural and municipal water users. This situation has resulted in the need to address these competing beneficial uses and sustainability concerns.

The Sacramento-San Joaquin Delta Reform Act of 2009 (Delta Reform Act) mandates the development of a comprehensive Delta management plan (Delta Plan) with the co-equal goals of (1) protecting, restoring,

and enhancing the Delta ecosystem, and (2) providing a more reliable water supply for California. The proposed Bay Delta Conservation Plan (BDCP) is anticipated to be the 50-year comprehensive conservation strategy component of the Delta Plan.

The Delta Reform Act also creates a new governing Council for the Delta and establishes a detailed plan for water conservation and efficiency. The bill requires the State Water Resources Control Board to establish environmentally protective inflow standards for the Delta prior to a change in the point of diversion for water exports. The bill created a new Delta Conservancy to acquire lands and to facilitate ecosystem restoration , and would revise the composition and duties of the Delta Protection Commission. Lastly, it establishes an independent science board to inform the Council and establishes a process for developing a Natural Communities Conservation Plan.

The BDCP is being developed in compliance with the federal ESA, the CESA, and the Natural Community Conservation Plan (NCCP). The BDCP's comprehensive conservation plan is also undergoing intensive environmental review, in the form of both a state Environmental Impact Report (EIR) and a federal Environmental Impact Statement (EIS). The EIR and EIS will both evaluate the conservation plan's impact on all aspects of the environment and will identify alternatives and mitigation actions.

Delta Ecosystem Restoration and Protection — The Conservation Plan

The federal and State ESA's presently regulate the operational impacts of the SWP and CVP on a species by species basis. The BDCP is a joint habitat conservation plan (HCP) and natural community conservation plan (NCCP) that seeks to improve the health of the Delta ecological system using a comprehensive conservation strategy to address the collective impacts associated with the SWP, CVP and certain existing and anticipated future actions within the area covered by the Plan. The BDCP takes into account multiple stressors on the ecosystem, the needs of multiple species, and the diverse natural communities that support them, including species listed under the federal and State ESA's as threatened, endangered or candidates for listing, inclusive of habitat, if any, designated for these species.

The BDCP aims to enhance the Delta's ecosystem processes and function, including seasonal floodplain habitat, intertidal and associated subtidal habitat, hydrologic conditions, and salinity within the Delta estuary, including a reduction in the direct loss of fish and other aquatic organisms. Specific problems to be addressed include the reconnection of floodplains, the development of new tidal marsh habitat, the restoration of river banks to a more natural state, invasive species control, decreasing water toxicity levels, and aligning water operations to better reflect natural seasonal flow patterns.

An overriding goal of the BDCP is to contribute to the recovery of at-risk species in the Delta. The BDCP seeks to accomplish this goal by identifying specific conservation and management actions, or conservation measures, to improve habitat conditions within the Delta's natural communities. The overall BDCP conservation strategy presently includes twenty-two (22) conservation measures that are designed to achieve biological goals and objectives specific to eleven (11) conservation zones comprising the Delta (Figure 4-2). [Reviewers: This figure will show information similar to the graphics on pages 28 and 29 at: http://baydeltaconservationplan.com/Libraries/Dynamic_Document_Library/Highlights_of_the_BDCP_FINAL_03-17-11.sflb.ashx.]

PLACEHOLDER Figure 4-2 [Title to Come]

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BDCP — Taking Conveyance a New Direction

Central to the BDCP is the proposal to develop an improved conveyance system which, different from past water plans, implements a conveyance strategy that takes into account the continued decline in the Delta ecosystem. Specifically, the BCDP proposes the creation of dual water conveyance delivery system comprised of the existing (Through Delta) conveyance and a new conveyance system that will route water through an isolated facility conveyance system to be exported via the SWP and CVP (Figure 4-3). [Note to reviewers: This figure will show information similar to the graphic on page 31 at the following URL: http://baydeltaconservationplan.com/Libraries/Dynamic_Document_Library/Highlights_of_the_BDCP_FINAL_03-17-11.sflb.ashx.] As proposed, the North Delta Diversion would become the primary diversion point and would be subject to water delivery operation rules. The new facility would help meet the dual, co-equal goals of the Delta Plan by providing for a more reliable supply of water while simultaneously maintaining sufficient bypass flows for State and federally listed species of concern.

PLACEHOLDER Figure 4-3 [Title to Come]

[Any draft tables, figures, and boxes that accompany this text for the advisory committee draft are included at the end of this chapter.]

Water Supply Reliability

There are many factors that influence water supply reliability. The distribution of precipitation and water demand in California is unbalanced as most of the state's precipitation falls in the north and a substantial amount of the state's water demand is south and west of the Delta. This includes irrigation water for southern Central Valley agriculture, and municipal and industrial uses in southern California and the Bay Area. Additionally, federal and State mandated regulatory actions to protect threatened and endangered species in the Delta have further limited the levels of through-Delta water conveyance which makes available water supplies even more unreliable.

To further compound these challenges, the Delta is not a static ecological system and fundamental changes are certain to occur. The anticipated effects of climate change indicate elevated sea levels, altered annual and inter-annual hydrological cycles, changed salinity and water temperature regimes in and around the Delta, and accelerated shifts in species composition and distribution. These changes further add to the difficulty in resolving the increasingly intensifying conflict between the ecological needs of at-risk Delta species and natural communities and the need to provide adequate and reliable water supplies for people, communities, agriculture, and industry. Anticipating, preparing for, and adapting to these changes are key underlying drivers associated with implementation of the proposed Bay Delta Conservation Plan.

Existing Delta conveyance does not provide long-term reliability to meet current and projected needs. Conveyance through the Delta in times of drought is especially challenging considering the various demands from agriculture, municipalities, and environmental needs. To improve through-Delta conveyance water supply reliability, provide greater operational flexibility, and improve ecosystem

function, improvements to existing facilities in the form of updating aging infrastructure, upgrading existing capacities, adding redundancy to the system, constructing additional facilities, and restoration of habitat may be needed.

The major issues pertaining to reliability of water supply transferred through the Delta include the following items:

- The health of the Delta ecosystem is paramount in consideration of water-related activities within the Delta. Continuing declines in some native species populations migrating through or living in the Delta, such as salmon and delta smelt, highlight the increasing influence of the Delta ecosystem on water supply reliability. Any activity proposed for Delta conveyance will need to consider the restoration and preservation of native habitat to benefit pelagic organisms and other native species.
- The integrity of more than 385 miles of Project levees and over 730 miles of non-Project levees throughout the Delta is continually undermined by such elements as storm events creating floods and seawater surges, island subsidence, natural levee erosion, poor quality peat soils used to build the original levees, seismic activity, burrowing animals, and sea level rise. These vulnerabilities call into question the long-term sustainability of using the Delta as a conveyance corridor.
- DWR's Delta Risk Management Strategy Phase II report recommends levee standards for the Delta to increase through-Delta water supply reliability and reduce risks to water conveyance and other values in the Delta overall.
- Maintaining optimal water quality within the Delta for both drinking water and for native species habitat is a challenge. Constituents of concern include, but are not limited to, salinity, bromide, chloride, organic carbon, nutrients, pathogens, dissolved oxygen, temperature, and turbidity. Control of water quality in a tidal estuary with seasonal and yearly fluctuating hydrology will require well understood and fully inclusive strategies. As water quality requirements can vary, and at times conflict among users, the challenge will be to agree upon the implementation strategy.
- Maintenance of in-Delta projects for beneficial uses such as recreational boating and swimming; sport fishing; shipping; and agriculture, industrial, and drinking water supply will be an ongoing management challenge as political and fiscal climates evolve and resources for competing priorities become scarcer.

Potential Benefits of Delta Dual Conveyance

Implementation of the proposed dual conveyance improvements will enable the operational flexibility to divert water at times and from places that are less harmful to fisheries and to reliably transport environmental water supplies to locations where or at times that are beneficial to both fish and water quality. The use of an alternative conveyance strategy will also allow for the restoration of a more natural flow of the waters feeding into and across the Delta east to west toward the Pacific Ocean. The potential also exists to increase flood control capability with higher and more controlled flow through the Delta.

Other specific benefits include:

- Optimal water supply conveyance through the Delta enables the success of the other resource management strategies.
- Conveyance can improve water quality by moving more water when water quality conditions are better or less impacted by the movement of water, or by supplementing natural river flows

and preventing excessive saltwater intrusion that can impair established beneficial uses and harm legal users of water in the Delta.

- Conveyance improvements include adaptive management which can provide the operational flexibility to divert and move water which may benefit fisheries and water quality.
- Reliable conveyance improves water transfers between willing buyers and sellers.
- During certain water years, groundwater and off-stream storage facilities can be replenished.
- Given the high-intensity, short duration characteristics of California's hydrology, improved conveyance capacities combined with adequate surface water or groundwater storage can enable diversions of more water during high flow, less competitive periods, and consequently reduce the pressure of water diversions during low flow, highly competitive periods. This strategy could have additional benefits as an adaptation to future climate change.
- Water quality in the Delta may be enhanced through sophisticated management projects controlling source water mixing and reducing salinity intrusion from seawater.

Other benefits of conveyance improvements, which can vary by specific location and hydrology, generally include:

- Enhanced new dual conveyance system may increase flood control capability with higher and more controlled flow through the Delta.
- Redundancy in the Delta conveyance system will provide increases in resiliency and may, therefore, ensure some continuation of services during extreme events such as a long-term drought or following a catastrophic seismic event in the Delta.
- A new conveyance system may allow the flexibility to pump water at optimal times, when energy costs are lower, and decrease pumping at peak energy demand periods, when energy costs are higher. Project analyses will need to consider that some benefits may be offset by costs to enhance or increase conveyance capacity.
- Conveyance improvements may allow for better matching of water quality for different beneficial uses. For example, conveyance of fresher river water at times of abundant supplies for municipal, industrial and agricultural purposes could allow for greater salinity fluctuation at times of reduced supplies for ecosystem benefits in some parts of the Delta.
- Streams and channels enlarged for conveyance and flood passage may incorporate riparian habitat improvements that are designed for varying hydrology (including climate change) and operations.

Potential Costs of Conveyance

Dual Conveyance — Implementation Costs and Funding Sources

A detailed discussion of the estimated costs associated with the implementation of the BDCP over the proposed 50-year term of the conservation plan can be found in Chapter 8 of the proposed Bay Delta Conservation Plan available at: http://baydeltaconservationplan.com/.

Major Issues and Considerations Facing Delta Dual Conveyance

The following list includes issues that have been identified by State and federal agencies and the public during this process:

- Water Supply, Surface Water Resources, and Water Quality – These remain highly controversial issues for a wide array of stakeholders because of the proposed changes in water

operations, surface water flow conditions, and diversions that could occur with changes to the SWP and CVP systems. Water Quality is an issue of concern because of uncertainties regarding activities associated with conveyance facilities and restored habitat could lead to discharge of sediment, possible changes in salinity patterns, and water quality changes that could result from modifications to existing flow regimes.

- Flood Management – Flood Management is a potentially controversial issue because implementation of the BDCP would entail modifications of some existing levees and changes in flow regimes including inundation of the Yolo Bypass.
- Socioeconomics – The key socioeconomic concerns involve the potential for loss of revenue and employment associated with the decrease in agricultural production associated with conversion of agricultural land to other uses, as well as the potential decrease in tax revenues due to such a decline in agricultural activities
- Growth – Increasing the reliability of water may allow additional growth within the south Delta or in export service areas.

Climate Change

Northern California is expected to experience changes to the physical environment as a result of climate change. It is expected that climate change will result in change from snow to rain in winter, leading to reduced snowpack, earlier snowmelt, and reduced river flows and reservoir storage in summer, causing changes to the seasonal timing of flows in rivers. Air temperatures will continue to rise, increasing water temperatures. Accelerated rates of relative sea level rise will increase the intrusion of seawater into the upper estuary . Sea level rise combined with an increase in coastal storms, storm surge, and river runoff will increase shoreline flooding and erosion. Sea level rise will continue to threaten infrastructure, increase flooding at the mouths of rivers, place additional stress on levees in the Delta, and will intensify the difficulty of managing the Delta as the heart of the state's water supply system.

Adaptation

Both the increase in winter runoff and more intense storm events anticipated with climate change may require larger conveyance capacity and reservoir storage to successfully manage water for flood risk reduction and water supply reliability. Delta conveyance improvements can provide additional resiliency for minimizing these impacts while providing more flexibility in managing water supplies and reducing flood risk, while benefiting the co-equal goals. Expected climate change adaptation benefits of Delta conveyance improvements include:

- Enhanced ecosystem services through restoration of wetlands, floodplains, and riparian habitats will restore ecosystem services that benefit humans as well as ecosystems, including flood control, water purification, sediment retention, carbon sequestration, and the provision of habitats and biota,
- Increased protection of upland habitat and human structures from flooding and storm surges due to sea level rise,
- Improved floodplain connections to rivers to restore the ability of floodplains to absorb flood flows and provide a reservoir of water to help aquatic species withstand droughts.
- Increased resilience to invasive species from creation of seasonally inundated floodplains by increasing numbers and health of native species and excluding invasive species
- Increased habitat variability helping to support species diversity by providing a mosaic of habitats that can be used by different species that have evolved to use specific habitats.

- Increased habitat complexity from wetland restoration, which will include networks of channels within marshes that are used by fish for foraging, refuge, and movement in and out of the marsh.
- Increased habitat patch size and connectivity through the protection and restoration of a variety of natural communities. Increasing patch size will tend to increase population sizes of native species, which provides more resiliency against a changing climate.

Mitigation

Higher concentrations of heat-trapping greenhouse gases in the atmosphere result in increasing global surface temperatures, a phenomenon commonly referred to as 'global warming'. Higher global surface temperatures in turn result in changes to the earth's climate system, including: the jet stream; El Nino: the Indian monsoon; ocean temperature and acidity; the entent of alpine glaciers;, sea ice, and polar ice sheets; the extent of deserts; atmospheric water content; and the extent and health of boreal and tropical forests. Some of the above changes will result in specific impacts at the state and local level. When considering climate change, the BDCP EIR/S will address two questions:

- What is the impact of the BDCP on climate change? — The effects of the alternatives on air quality, criteria pollutants, and GHG emissions from construction and operations were assessed and quantified using standard and accepted tools, techniques, and emission factors. Construction and operation of the proposed water conveyance facility would generate emissions of criteria pollutant and GHGs that would result in short-term and long-term effects on ambient air quality in the study area. Potential air quality and GHG impacts were assessed in relation to relevant thresholds of significance established by agencies with jurisdictional authority, and/or applicable laws and regulations, including Appendix G of the State CEQA Guidelines.
- How will the study area be affected by climate change? — This function is to analyze and disclose how the alternatives, as described in the EIR/S affect the BDCP project area's resiliency to expected changes in climate. BDCP components that could be subjected to the effects of climate change consist of water diversion and conveyance facilities combined with differing operational scenarios, conservation components, and components related to reducing other stressors. Some of the resource areas that could be affected by climate change include water supply, water quality, fish and aquatic resources, terrestrial resources, and agricultural resources. The potential climate change effects that could impact these, and other resource areas, include increased air temperature, reduced precipitation/runoff volumes, increased frequency/severity of floods and/or droughts, sea level rise, and increased salinity intrusion.

Recommendations to Improve and Protect Delta Conveyance

There can be no sustainable and reliable water supply without a healthy Delta ecosystem free of court-ordered, individual species protection actions. At the same time, the Delta ecosystem cannot remain healthy if the state's economy suffers for lack of water. In order to reach the co-equal goals necessary to successfully improved Delta conveyance , the following recommendations include:

- Legally acknowledge the co-equal status of restoring the Delta ecosystem and creating a more reliable water supply for California.
- Recognize and enhance the unique cultural, recreational, and agricultural values of the Delta as an evolving place, an action critical to achieving our co-equal goal.
- Restore the Delta ecosystem as the heart of a healthy estuary.

- Promote water conservation, efficiency, and sustainable use.
- Build facilities to improve the existing water conveyance system and expand state wide storage, and operate both to achieve the co-equal goal.
- Reduce risks to people, property, and state interests in the Delta by effective emergency preparedness, appropriate land uses and strategic levee investments.
- The Delta Risk Management Strategy (DRMS) Phase 2 report builds on the knowledge gained from the DRMS Phase 1 assessment to evaluate scenarios which could reduce the risks to the State's economy.
- The California Urban Water Management Planning Act requires urban water suppliers to adopt water management plans every 5 years and submit to DWR. In these plans, urban water suppliers must assess whether their current and planned water supplies will be enough to meet the water demands during the next 20 years. DWR is required to review local water management plans and report on the status of these plans.
- The Water Conservation Act of 2009 includes distinct requirements related to both urban and agricultural water use. DWR is required to report on progress toward meeting urban per capita water use goals.
- Through its Agricultural Water Management Planning and Implementation Program, DWR helps water districts develop agricultural water management plans and implement cost-effective efficient water management practices.
- DWR will participate in workshops and technical discussions about managing for extreme drought and floods.

2011 BDCP Accomplishments

Important BDCP accomplishments of 2011 include refinements to habitat conservation measures including the Yolo Bypass Fishery Enhancement and the South Delta Habitat and Flood Management Improvement. Another key accomplishment was the development of a range of alternative conveyance options (Table 4-1) and the development of comprehensive biological goals and objectives for specified fish species. A comprehensive overview of 2011 BDCP accomplishments can be found at: http://baydeltaconservationplan.com/. [Note to reviewers: This table will recreate the table on Page 4 of http://baydeltaconservationplan.com/Libraries/Dynamic_Document_Library/BDCP_2011_Accomplishments_Brochure.sflb.ashx.]

PLACEHOLDER Table 4-1 Range of Alternatives

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Personal Communications

Figure 4-1 Sacramento-San Joaquin River Delta